

Automated Attendance System Using Face Recognition Technique

Sumanta Chatterjee, Adit Jana, Adrija Ganguly, Aditi Ghosh

Abstract— The objective of this system is to present an automated system for human face recognition for an organization or institute to mark the attendance of their students or employees. This paper introduces face detection method using the Viola and Jones algorithm and recognition using correlation technique. The system will record the attendance of the students in class room environment. The above system is fully automated and easily deployable. User gets an authentication to upload the image containing file and also to view the attendance.

Index Terms— Automated, Face Detection, Face Recognition, Viola and Jones Algorithm, Correlation, Attendance.

I. INTRODUCTION

Face recognition is as old as computer vision, both because of the practical importance of the topic and theoretical interest from cognitive scientists. Despite the fact that other methods of identification (such as fingerprints, or iris scans) can be more accurate, face recognition has always remains a major focus of research because of its noninvasive nature and because it is people's primary method of person identification. Face recognition technology is gradually evolving to a universal biometric solution since it requires virtually zero effort from the user end while compared with other biometric options. Biometric face recognition is basically used in three main domains: time attendance systems and employee management; visitor management systems; and last but not the least authorization systems and access control systems. Traditionally, student's attendances are taken manually by using attendance sheet given by the faculty members in class, which is a time consuming event. Moreover, it is very difficult to verify one by one student in a large classroom environment with distributed branches whether the authenticated students are actually responding or not.

II. PROPOSED SYSTEM ARCHITECTURE

A. Application layer

There is the capturing phase in this the user captures the frames and using a web app that runs on almost all platforms upload the file to the server. Authentication is provided to the users. This web app is used to upload captured frames as well

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as to view the attendance.

B. System layer

This is the layer where the processing is done that is the detection and recognition part at the server side. Viola and Jones algorithm is used to detect images from the frames.

Initially an integral image is generated from the frame which simply assigns numbers to the pixels generated by summing up the values. Further to detect the objects from the frames the Haar-like feature is generated and as millions of features being generated Adaboost (boosting algorithm) is used to enhance the performance. The extracted features are passed through a trained classifier which detects the faces from the objects.

These detected faces are cropped and passed through the recognition module which by applying correlation to the cropped images and the images in the databases recognizes the faces.

C. Database layer

The Database layer is a centralized database system which consists of student database and their attendance. The student database is formed by initial feeding of the frames from which system detects faces crops them and stores it to the database and these stored images are hence forth used for the recognition part. The results of the face recognition module are compared with the images from the student database and after the successful comparison the attendance is updated to the database. The sheet is generated and uploaded to the web app.

III. ALGORITHM

A. VOILA AND JONES ALGORITHM

Viola and Jones algorithm is used for face detection. Where it is used in both creating database and face recognition process. Where in case creating database it takes input image through a web camera continuously. Captured image undergoes face detection. Detected face will be cropped and stored in database. Where in case of face recognition if there is any movement video surveillance will be used to detect the moving object. The captured image undergoes face detection and further processed later by face recognition. Cross-Correlation and Normalized-Correlation are used to extract the Coordinates of peak with the RIO and target images. The peak of the cross-correlation matrix occurs where the sub images are best correlated. Find the total offset between the images. The total offset or translation between images depends on the location of the peak in the cross correlation matrix, and on the size and position of the sub images. Check if the face is extracted from the target Image. Figure out where face exactly matches inside of target image. This algorithm mainly has following functionality.

IV. CONCEPTUAL DIAGRAM

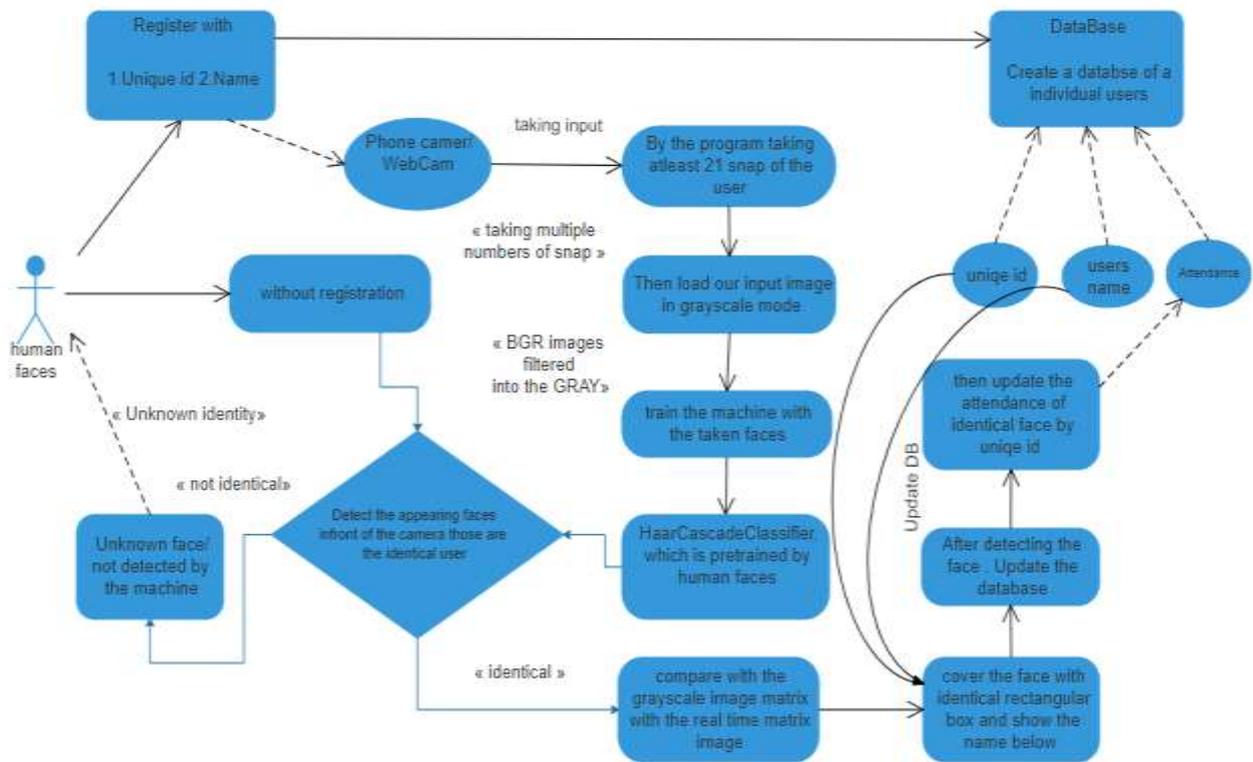


Fig A: Conceptual Diagram of the system

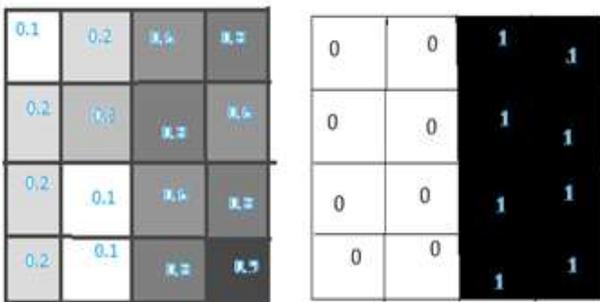


Fig B: color representation through matrix.

Ideal Haar-feature pixel intensities 0: white color, 1: black color. These are the real values to detect an image. Let's sum up the white pixel intensities. calculate the sum of the black pixel intensities.

$$\Delta = 1/n \sum_{dark} 1(x) - 1/n \sum_{white} 1(x)$$

Δ for ideal Haar-feature is 1.
 Δ for the real image: $0.74-0.18=0.56$, The closer value to 1, the more likely we have found a Haar-feature !!(of course we will never get 0 or 1: there are thresholds).

V. MECHANISM FOR FACE DETECTION

A. Face Detection

Integral image or summed area table is a data structure and algorithm for quickly and efficiently generating the sum of values in a rectangular subset of a grid. In the image processing domain, it is also known as an integral image.

Haar-like features are digital image features used in object recognition. They owe their name to their intuitive similarity with haar wavelets and were used in the first real-time face detector. All human faces share some similar properties. These regularities may be matched using Haar Features. A few properties common to human faces: The eye region is darker than the upper-cheeks. The nose bridge region is brighter than the eyes.

Composition of properties forming matchable facial features: Location and size: eyes, mouth, bridge of nose Value: oriented gradients of pixel intensities the four features matched by this algorithm are then sought in the image of a face (shown at right).

Rectangle features:

Value = Σ (pixels in black area) - Σ (pixels in white area) Three types: two-, three-, four-rectangles, Viola & Jones used two-rectangle features, the difference in brightness between the white & black rectangles over a specific area Each feature is related to a special location in the sub-window Adaboost (adaptive boost) meta-algorithm formulated by yoav freund and robert schapire which is use to improve the performance of other algorithm. Viola and jones extracts the millions of features (pixels) for comparison so, we adaboost to enhance the overall performance and calculation speed of the algorithm.

Cascade classifier is a particular case of ensemble learning based on the concatenation of several classifiers, using all information collected from the output from a given classifier as additional information for the next classifier in the cascade.

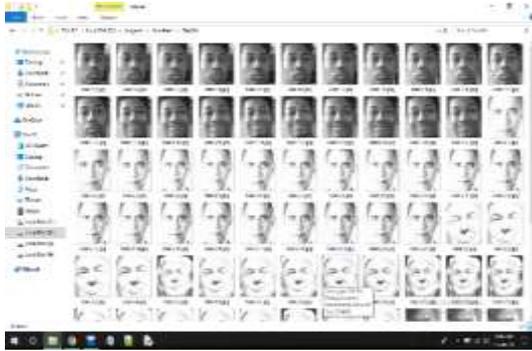


Fig F: Stored black & White images

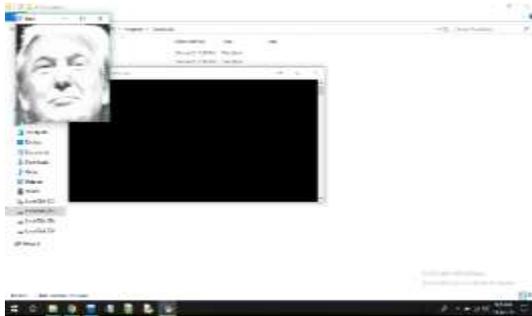


Fig G: Train images in the Datasets

VIII. CONCLUSION

In order to obtain the attendance of individual and to record their time of entry and exit, the authors proposed the attendance management system based on face recognition technology in the institutions/organizations. The system takes attendance of each student by continuous observation at the entry and exit points. The result of our preliminary experiment shows improved performance in the estimation of the attendance compared to the traditional black and white attendance systems. Current work is focused on the face detection algorithms from images or video frames.

REFERENCES

- [1] A. J. Goldstein, L. D. Harmon, and A. B. Lesk, "Identification of Human Faces," in Proc. IEEE Conference on Computer Vision and Pattern Recognition, vol. 59, pp 748 – 760, May 1971
- [2] M. A. Fischler and R. A. Elschlager, "The Representation and Matching of Pictorial Structures," IEEE Transaction on Computer, vol. C-22, pp. 67-92, 1973.
- [3] Y. Cui, J. S. Jin, S. Luo, M. Park, and S. S. L. Au, "Automated Pattern Recognition and Defect Inspection System," in proc. 5 th International Conference on Computer Vision and Graphical Image, vol. 59, pp. 768 – 773, May 1992.
- [4] M. H. Yang, N. Ahuja, and D. Kriegmao, "Face recognition using kernel eigenfaces," IEEE International Conference on Image Processing, vol. 1, pp. 10-13, Sept. 2000.
- [5] Y.-W. Kao, H.-Z. Gu, and S.-M. Yuan "Personal based authentication by face recognition," in proc. Fourth International Conference on Networked Computing and Advanced Information Management, pp 81-85, 2008.
- [6] P. Sinha, B. Balas, Y. Ostrovsky, and R. Russell, "Face Recognition by Humans: Nineteen Results All Computer Vision Researchers Should Know About," in Proceedings of the IEEE, vol. 94, Issue 11, 2006.
- [7] Paul Viola, Michael Jones, 'Rapid Object Detection using a Boosted Cascade of Simple Features', Accepted Conference on Computer Vision and Pattern Recognition, 2001
- [8] FacedetectionWikipedia<https://en.wikipedia.org/wiki/Face_detection
- [9] Face detection – facedetection.com.

- [10] Inseong Kim, Joon Hyung Shim and Jinkyu Yang (2016)Face Detection, Stanford University, International Journal of Engineering Research and Applications, Vol. 6, Issue 1, pp145-150.
- [11] tutorials.readthedocs.io/en/latest/py_tutorials/py_objdete ct/py_face_detection/py_face_detection.html?highlight=opencv%20face#haar-cascade-detection-in-opencv
- [12] R.O. Duda, P.E. Hart, Pattern Classification and Scene Analysis., New York::, 1973.
- [13] W.E.L. Grimson, T. Lozano-Perez, "Model-Based Recognition and Localization From Sparse Range Data",Techniques for 3-D Machine Perception., 1985.
- [14] M. Turk, A. Pentland, "Eigenfaces for Recognition".,J. Cognitive Neuroscience, vol. 3, no. 1, pp. 71-86, 1991.
- [15] A.Yuille,P.Hallinan, D. Cohen, "Feature ExtractionFromFacesUsingDeformableTemplates".,Int'l J. Computer Vision, vol. 8, no. 2, pp. 99-111, 1992.
- [16] K. Sung, Learning and Example Selection for Object and Pattern Detection, 1995
- [17] D. Rumelhart, J. McClelland, Parallel Distributed Processing, Cambridge, Mass.::, vol. 1, 1986.
- [18] T. Poggio, T. Vetter, "Recognition and Structure From One (2D) Model View:Observations on Prototypes Object Classesand Symmetries"., 1992.

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